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THE PROGRESS OF SCIENCE

CURRENT COMMENT

By Dr. Edwin E. Slosson

Science Service

RELATIVITY AND THE ECLIPSE

On September 21 the theory of relativity was put to the proof. After the results of the photographs then taken have been measured we may perhaps know whether Einstein is to be ranked with Copernicus and Newton, among those who have revolutionized man's conception of the universe, or whether he will be regarded merely as the author of an ingenious mathematical theory of limited applicability to reality.

For the last three years the theory of relativity has been the topic of lively discussion extending far beyond the scientific circle, for the public realized that some interesting issues were somehow involved in its incomprehensible mathematics. More than a thousand books and uncountable articles have been published on Einstein; all sorts, *pro* and *con*, physical and metaphysical, experimental and speculative, serious and frivolous. Prizes have been offered for explanations in ordinary language. Personal, political, religious and racial passions and prejudices have been aroused. Einstein was the first German scientist to be welcomed since the war, in England, France and the United States, but in his own country he has to go into hiding to escape assassination by the junkers.

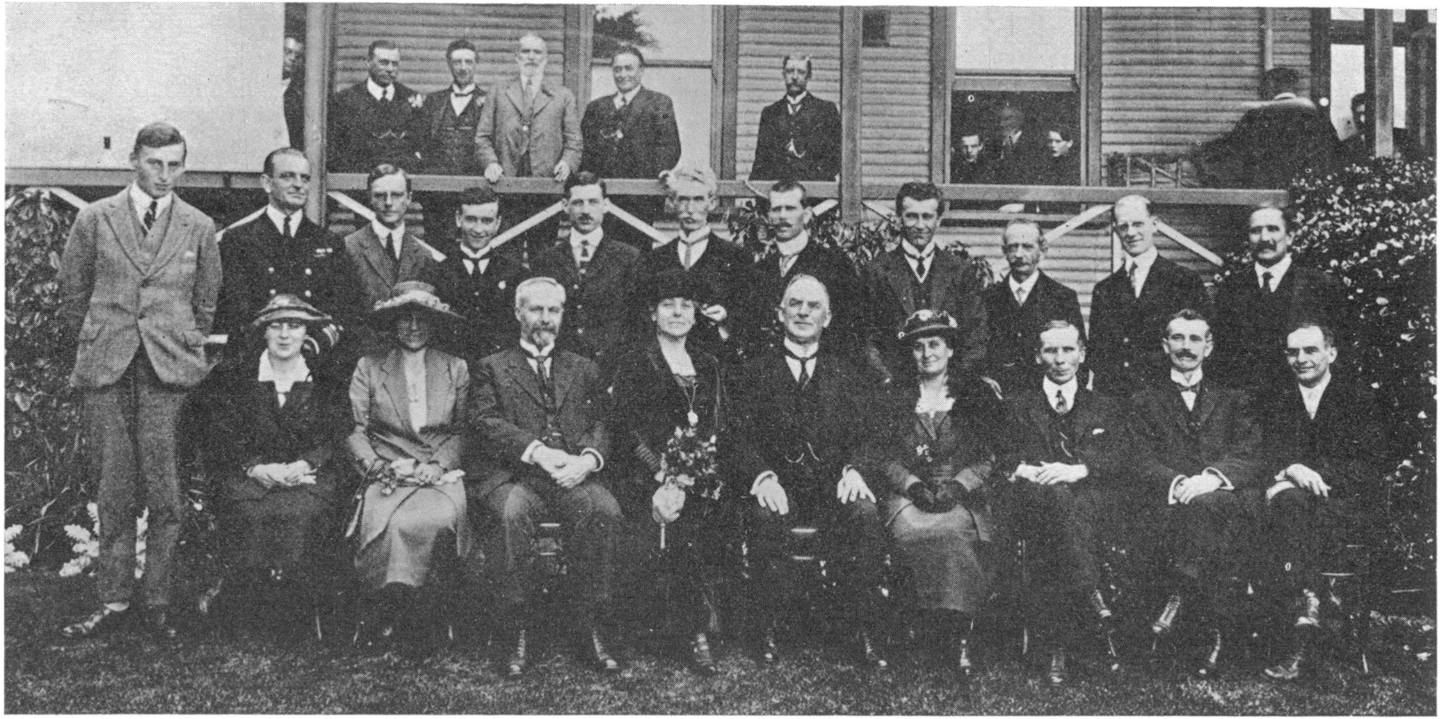
It is a remarkable example of how the progress of science may continue in spite of political conflict that during the world war Einstein should have sat quietly in his study in Berlin thinking out his theory and that during the world war English astronomers should have been quietly studying his work and preparing to put it to the test at the earliest opportunity.

This opportunity came on May 29, 1919, when there was a total eclipse of the sun. For Einstein had predicted that when the stars about the darkened disk of the sun were photographed they would appear as though pushed out of their positions. This is one of the consequences of his theory of relativity, which is designed to supplant, or at least to supplement, Newton's theory of gravitation.

According to Einstein, a ray of light from a star passing close by a heavy body like the sun is drawn out of its straight course a little, somewhat as though it were a stream of material particles, but to a greater extent than Newton's law would allow for. To an astronomer looking up at the star along this crooked path and not making allowance for the bend, it would seem that the star had been moved away from the sun a minute distance (1.74 seconds of arc). Of course this effect is the same at all times, but it can only be observed when the sun's disk is completely shadowed from us by the moon's coming between.

So the British astronomer royal, Professor Eddington, sent out two eclipse expeditions in 1919 to points where the eclipse could be observed, one to the west coast of Africa and the other to the east course of Brazil. When he came to develop and measure up his photographs, he found that the stars about the darkened sun were displaced in the direction and close to the amount predicted by Einstein.

This was good evidence in Einstein's favor, but scientists are cautious creatures and not all of them



THE WESTERN AUSTRALIAN ECLIPSE PARTY

World Wide Photos

The members of the eclipse party, photographed prior to their departure from Perth, Western Australia, for Wallal. Standing, left to right: J. Clark Maxwell, H. L. Quick, J. Hargreaves, J. P. C. Hoskinds, Dr. R. J. Trumpler, J. J. Dwyer, C. Nossiter, V. J. Mathews, C. S. Yates, Dr. J. H. Moore, G. M. Nunn. Sitting: Miss Chant, Mrs. Adams, Dr. C. E. Adams, Mrs. Campbell, Dr. W. W. Campbell, Mrs. Chant, Dr. C. A. Chant, A. D. Ross and Dr. Young.

were ready to accept so startling a theory as this without further confirmation. The weather was very cloudy in Africa, and the only good photograph obtained at the South American station was one taken with a four-inch lens and showing seven stars around the sun.

But there has been no other total eclipse observable till this year and this is not so good a one. There were no bright stars near the sun, in fact only one visible to the naked eye among those close enough to the sun so that their displacement could be measured. But there were four or five faint stars that may have been caught on a sensitive plate with a good telescope.

Unfortunately too, the eclipse occurred in a highly inconvenient part of the earth. Its track was along the Indian Ocean and through the heart of Australia where there are no observatories and few people. The best point was on Christmas Island, lying west of Australia and south of Java. This island only measures eight by twelve miles and has a population of about 250, according to the latest census. But it was selected by the British, German and Dutch expeditions for it was in the middle of the track of the eclipse. The darkness there lasted five minutes and astronomers can do much in five minutes. It appears, however, from cable despatches that the weather conditions were bad. An expedition from the Lick Observatory, California, was stationed on the west coast of Australia, and the Observatory of Adelaide sent a party into the arid interior of Australia, which involved five weeks of travel by camel train but which was pretty certain to get cloudless weather. In Australia the weather was favorable.

If the astronomical expeditions now in the field bring home confirmation of the results of the eclipse of 1919, then we may have to get used to all sorts of queer ideas, besides crooked beams of light in empty space. We may have to give up the force of gravitation and the ether and the constancy of mass and the distinction between matter and energy. We may get to talking about the curvature of time, the weight of heat, kinks in space, atoms of energy, four dimensions, world-lines and a finite universe. We may be called upon to come to conceive of arrows that shrink and bullets that get heavier the faster they travel; of clocks that go slower the faster they travel and of a future that turns back and tangles itself up in the present.

TANGLING UP THE TIME LINE

EINSTEIN'S theory of relativity is like a magician's bag. There seems to be no end to the queer things that can be pulled out of it. The more it is studied the more paradoxical it appears.

The latest thing I have seen is the queerest, the idea that the future may get tangled up in the present or even in the past. It is all worked out mathematically in a book just translated from the German, Weyl's “Time-Space-Matter.” Too mathematical for most of us, but the point in plain language is this:

Here is a line representing the course of time extending from the dim past into the indefinite future:

Past | Future

The present is the point where I stand, looking both ways like Janus but not seeing any end in either direction. I am continually moving or being moved straight along the time road from left to right. Every instant I step from the past into the future. Every instant a bit of time is taken from the future and added to the past, though neither gets any smaller or larger since both are infinite. The past time and the future time are permanently separated by the moving present where I am and